the physical properties of writing substrates that is important is the ability of the substrate to resist deformation during the writing process. Yield point is an indication as to what degree the material can withstand this pressure. While some differences in physical characteristics were noted between brands and types of off-the-shelf, ready-to-spread frostings, these differences were relatively minor. Pillsbury Company's Creamy Supreme Frosting was tested and found to exhibit a yield point of between approximately 10 and 20 grams per square centimeter at 23°C. This figure can be somewhat misleading however, since the frosting product exhibits thixotropic properties and will exhibit a higher instantaneous yield point than that determined through static testing. For example a sufficiently soft, and flexible writing nib can be used to write on the surface of the aforementioned frosting with minimal deformation to the frosting even though instantaneous forces generated by the nib on the frosting somewhat exceed static yield points for the frosting.

In order to produce an effective writing tool for soft frostings and other soft substrates, it is necessary that the force generated by these writing tools on the substrate not significantly exceed the instantaneous yield point of the substrate. To the extent that the force generated by the writing tool exceeds the yield point of the frosting, the writing tool will deform the frosting. While frosting is discussed as the primary substrate in this example, any very soft substrate will present similar problems to writing when using traditional writing instruments.

It was not surprising that we were unable to find preexisting writing instruments which possessed the necessary properties to satisfactorily write on soft substrates. Pencils, ball-point pens and felt-tipped markers were tested for this application. The pencils and ball-point pens were incapable of creating any marking agent indicia on the frosting surface. The felt-tipped markers tested were capable of transferring some ink to the frosting but not without causing significant damage to the surface of the frosting. Additionally, the frosting quickly coated the marker nib making further fluid transfer impossible. It was determined that in the case of the tests involving felt-tipped markers that the marker nib was too inflexible to effectively transfer fluid to the surface of the soft frosting without damaging the surface of the frosting. The existing products incorporating felt tips previously discussed and intended for writing on food surfaces were tested in this application as well. While it was found that the products were indeed capable of writing on hard, dry food surfaces such as, for example, a soda cracker or a starch wafer, the products were incapable of satisfactorily writing on soft foods such as fresh frosting or flavored gelatin products. Not only was fluid transfer to soft substrates intermittent and poor but the substrate suffered significant deformation and damage due to the forces exerted on the substrate by the hard nibs in these products. Additionally, it was difficult to accurately control the position of the pen nibs of these products relative to the soft frosting substrate. It should be noted here that this difficulty of control stems from the fact that there is very little tactile feedback to the user when attempting to write on extremely soft substrates. One who is accustomed to writing with a conventional felt-tipped

pen on a hard surface, for example, a piece of paper backed up by a counter top, can simply bring the pen tip down to the surface of the paper until it stops. Unless the user is applying an extremely large force to the pen, the pen nib will simply be stopped from further downward travel by the object being written upon. This is not the case with extremely soft substrates. Indeed, the moment of contact between a marking nib and an extremely soft surface such as fresh frosting can not even be discerned through the resulting back force from the nib acting through the pen body. Attempting to guide a hard nib accurately over the surface of an extremely soft substrate is a nearly impossible task without some form of tactile feedback. If a mechanism could be devised which could provide a buffer between the user's hand motion which is guiding the nib and the possibly, irregular soft surface being written upon it is possible that accurate fluid transfer to extremely soft surfaces could be achieved. A nib which possessed the desirable fluid transfer properties and which was extremely flexible could provide this buffer action by flexing in response to contact with soft substrates. The flexure would help to compensate for variations in forces applied to the pen by the user so that the resulting forces would not be fully transferred to the surface of the substrate. After examining several dozen samples of writing nibs from nib manufactures, it was determined that all such nibs were, too stiff and provided insufficient fluid transfer to the substrate.

Since we were unable to find a commercially produced nib which functioned as desired, a search was initiated to locate a material and develop a process which